



Module wind load resistance: Standards vs. reality

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Presented By



Scott Van Pelt, P.E.

Chief Engineer

Scott Van Pelt is Chief Engineer of GameChange Solar and is responsible for the execution and accuracy of GameChange's technical deliverables. He is a Professional Engineer licensed in sixteen states and functions as the Structural Engineer of Record for many of the company's projects. With over a decade of experience in the renewable energy space, Scott has served as a member of several national and international standards committees.

Scott.VanPelt@gamechangesolar.com

(212) 388-5164

GameChange Solar

- Fixed Tilt and Tracker System
- Started in 2012
- Over 12 GW Sold
- HQ in USA, Installed on 6 continents
- In-House Engineering



1P Tracker



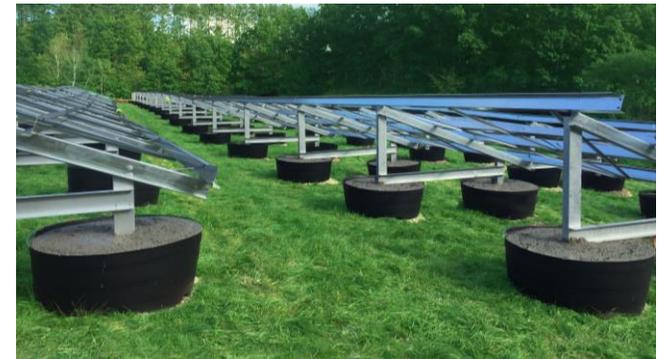
2P Tracker



2P Fixed



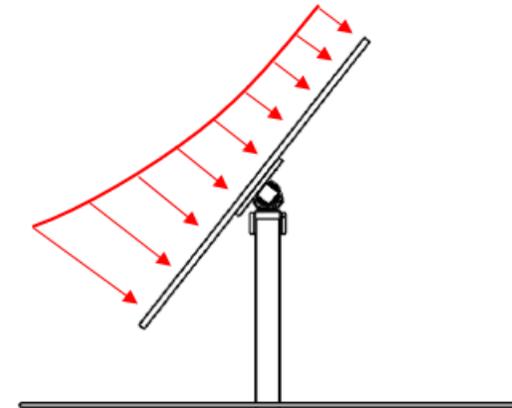
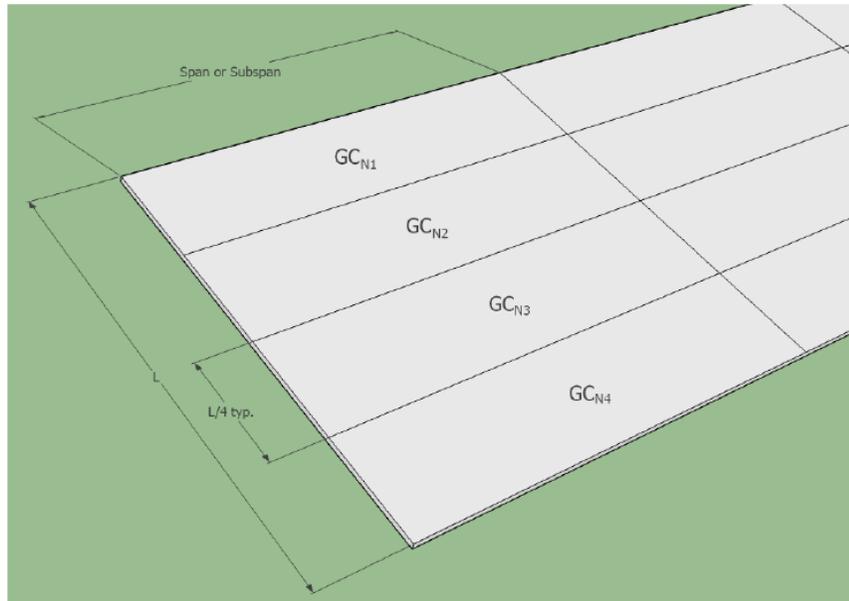
3P Fixed



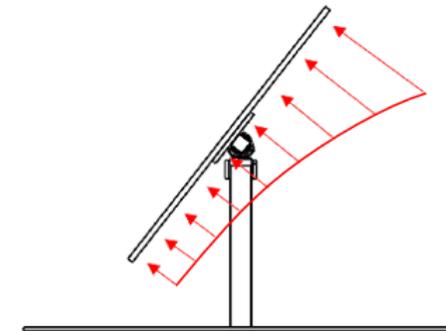
Ballasted Fixed

Pressure Gradient – What it means for the Structure

- Provided as quadrant gust coefficients from CPP
- Applicable to Fixed Tilt and Trackers
- Fixed tilt structure accommodates gradient without causing torsion of any component



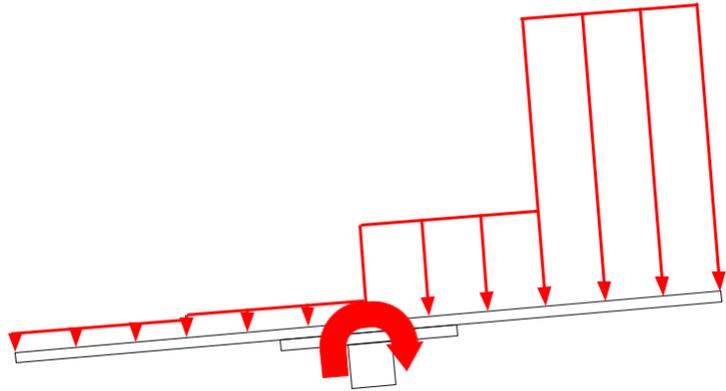
Perimeter Downforce



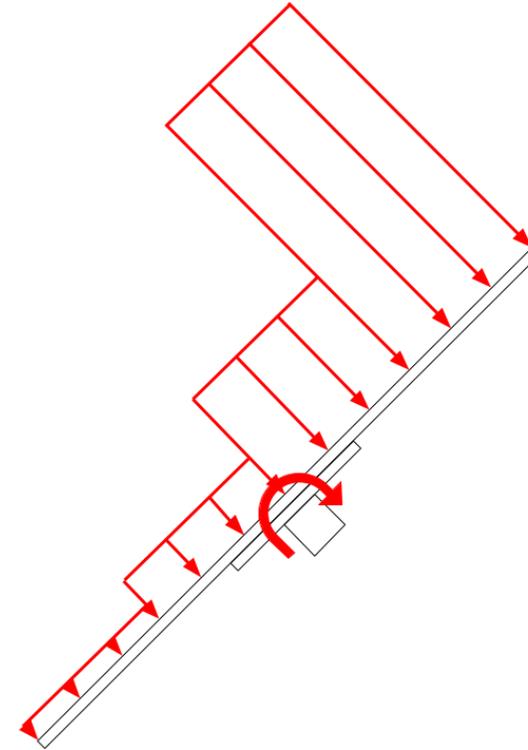
Perimeter Uplift
Interior Uplift

Structural Impact: Tracker Torque Tube

Pressure Gradient applicable to both trackers that stow flat and that stow at a high angle



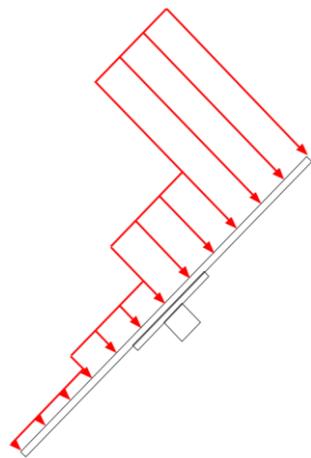
Stow Flat
Lower Normal Pressure
Higher Torque



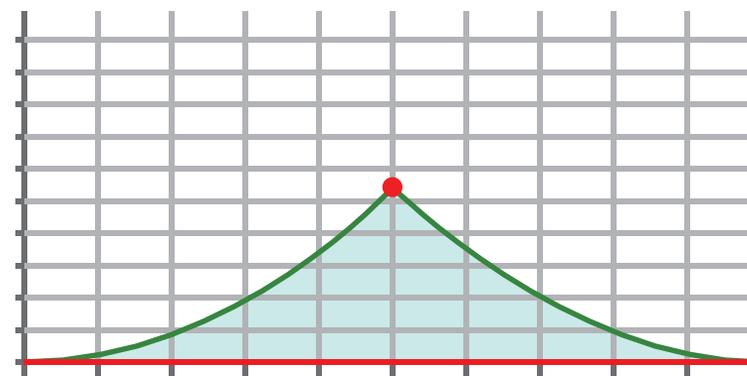
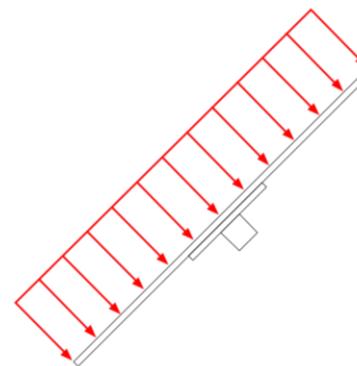
Stow at High Tilt
Higher Normal Pressure
Lower Torque

Structural Impact: Tracker Purlin (Mounting Rail)

Averaging the wind pressure artificially lowers the maximum load accounted for in the design



Rail Bending from Quadrant Pressures

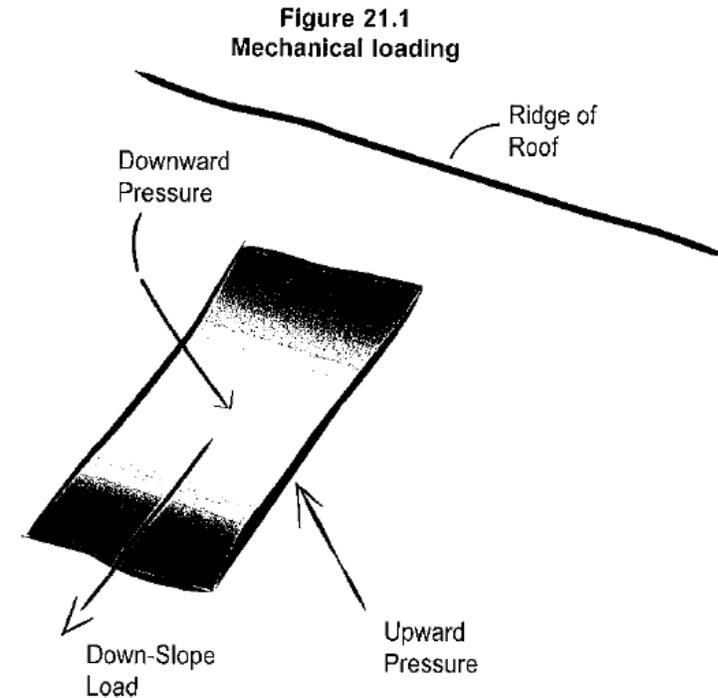


Rail Bending from Average Pressure

Existing Standards Environment

UL 2703 & IEC 61215

- Only allow for balanced load applied to entire panel
- Does not include provisions to allow for unbalanced test load
- Test load accounts for safety factor
- Recent changes to standards allow for lower strength modules which may not have mechanical capacity to support unbalanced wind pressure in even modest design wind speeds



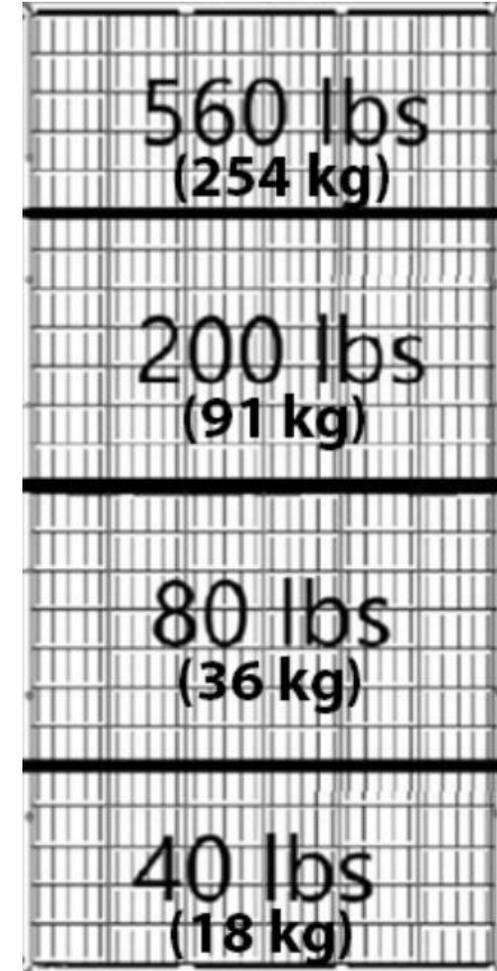
Unbalanced Mechanical Testing

Testing can be performed to confirm “real” strength of Panel + Rail Assembly

- Loading pressures calculated from quadrant loads provided by CPP
- Pressure per strip derived from gust coefficient equations in ASCE7 / EN 1991-1-4

$$\frac{F_N}{A_{ref}} = q_z \times GC_N$$

- Can be project specific (accounting for site design wind speed, GCR, height adjustment factor, panel length)
- Test load still includes Safety Factor
- Perform pre and post tests same as UL / IEC Standards (IR, EL, etc.)



PV Module and Rail Act as Assembly

- Mechanical capacity is function of both PV module and rail
- Rail can be “Bottom Mount” with hat (omega) purlin with bolt and nut or can be clamping system such as GameChange SpeedClamp™
- Mounting location matters
- Longer rails provide more support to panel and yield greater mechanical rating of assembly
- Longer rails are more expensive
- Taller modules (40mm or 35mm) tend to have higher capacities than 30mm modules



Bottom Mount



SpeedClamp™

Impact of New Module Types

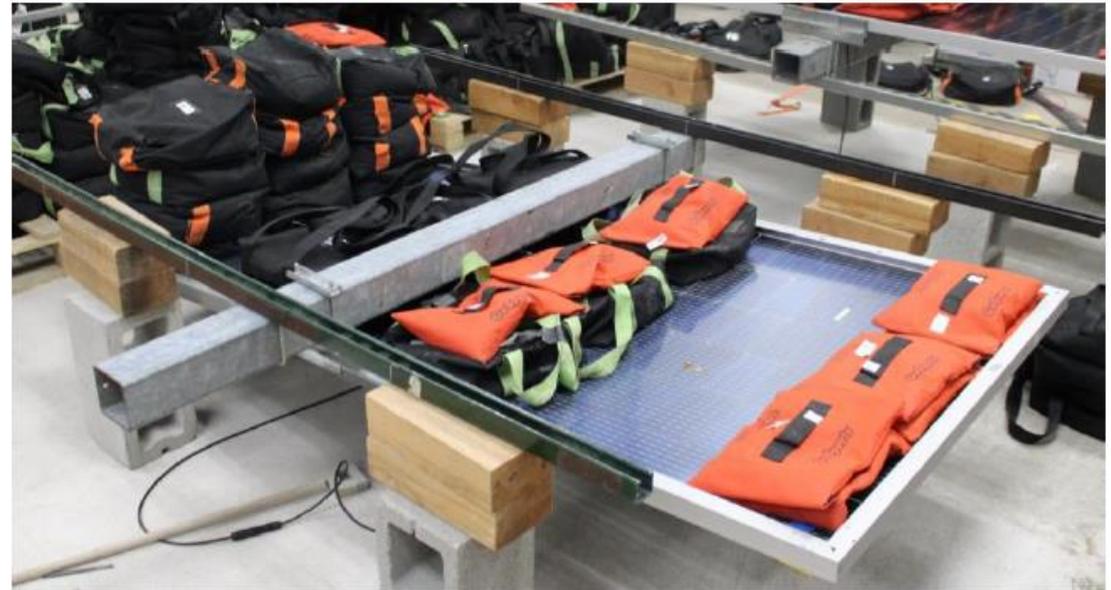
Bifacial Modules

- Smaller frames and lack of backing bar often reduce tested mechanical strength of Module

Large Format Modules

- Larger Panel Area increases force per mounting location (bolt or clamp) for the same wind pressure
- Longer modules increase bending moment on the mounting rail

Larger Modules Exacerbate Impact of Unbalanced Loading





THANK YOU

MERCI 谢谢 GRACIAS

ありがとう DANKE धन्यवाद

OBRIGADO GRAZIE